IN VITRO BIOCOMPATIBILITY ASSESMENT OF ANIONIC AMINO ACID OR PEPTIDE CONJUGATED POLYHEMA CO-POLYMERS FOR BONE TISSUE ENGINEERING APPLICATIONS

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We have generated a library of polyHEMA-based hydrogel polymers conjugated with anionic amino acid and peptide ligands that induce the formation of calcium phosphates in vitro under various mineralization conditions. This results in a polymer/ceramic composite material. The microstructure and crystallinity of the nucleated mineral has been analyzed using SEM and energy dispersive x-ray analysis and vary as a function of mineralization conditions. These materials were designed as bone mimics. In order to determine how the anionic amino acid and peptide ligands are interacting with bone cells at the molecular level, we have performed a series of high throughput gene expression experiments using Affymetrix Human Genome Arrays (Affymetrix, Santa Clara, CA). In order to isolate gene expression changes due to the interactions of the peptides and amino acid ligands on bone cells, we made flat glass surfaces displaying the library of conjugates. Cells exposed to these test slides and to tissue culture polystyrene control surfaces were studied using the microarrays. The data from these experiments were analyzed using a robust mean analysis at the probeset level and analysis of variance at the chip level. A set of genes that were significantly differentially expressed ($p<0.001$) between the control cells and the cells grown on the model surfaces containing anionic mineral-nucleating ligands was identified. Relating this list of genes back to what is known about the biology of healthy bone, we can begin to determine how closely our material mimics bone matrix in its ability to guide mineralization and bone cell activity.